

WINDBREAK/SHELTERBELT ESTABLISHMENT (FEET)

CODE 380

MONTANA TECHNICAL GUIDE

SECTION IV

DEFINITION

Linear plantings of single or multiple rows of trees or shrubs established for environmental purposes.

PURPOSES

- Reduce wind erosion.
- Protect growing plants.
- Manage snow.
- Provide shelter for structures and livestock.
- Provide wildlife habitat.
- Provide a tree or shrub product.
- Provide living screens.
- Improve aesthetics.
- Improve irrigation efficiency.

CONDITIONS WHERE PRACTICE APPLIES

On any areas where woody plants are suited.

Slopes greater than 15 percent are generally considered unsuitable for windbreak plantings. Windbreaks can be planted on steeper slopes, but special precautions need to be taken to control water erosion.

CRITERIA

General Criteria Applicable To All Purposes Named Above

The location, layout and density of the planting will accomplish the purpose and function intended within a 20-year period.

The maximum design height (H) for the windbreak or shelterbelt shall be the expected height of the tallest row of trees or shrubs at age 20 for the given site. Height may be estimated based on:

- 1) documented heights found in the Conservation Tree/Shrub Suitability Groups (CTSG) located in Section II of the Montana Field Office Technical Guide (FOTG); or,
- 2) performance of the individual species in nearby areas or similar sites.

Species Selection

Species must be suitable and adapted to the soils, climate and purpose. See Conservation Tree/Shrub Suitability Group (CTSG) in Section II of the Montana FOTG for a detailed listing of species suited to the soils and environmental factors at the site.

Use single or multiple species in a row. Change species where the soil type dictates a change. When choosing multiple species in a row, select species of approximately the same height and similar growth characteristics.

Plantings should have a different species for each row to add diversity to the planting in case of insect and disease concerns occur and for additional wildlife benefits.

NOTE: This type of font (**AaBbCcDdEe 123..**) indicates NRCS National Standards.
This type of font (**AaBbCcDdEe 123..**) indicates Montana Supplement.

Windbreak Design

The planting will be located on the windward side of the area to be protected and oriented as close to perpendicular to the troublesome wind as possible.

The most effective windbreak planting has five rows of deciduous and evergreen trees and shrubs. The greater the height of the trees within the windbreak, the greater the downwind distance protected.

Arrange rows with one or two rows of shrubs on the windward side and the taller trees in the center. At least one row of evergreens is desirable for maximum year round density and they should occupy a leeward row of the windbreak. Fruit bearing trees and shrubs may be planted to the leeward of the evergreen row. (SEE FIGURE 1)

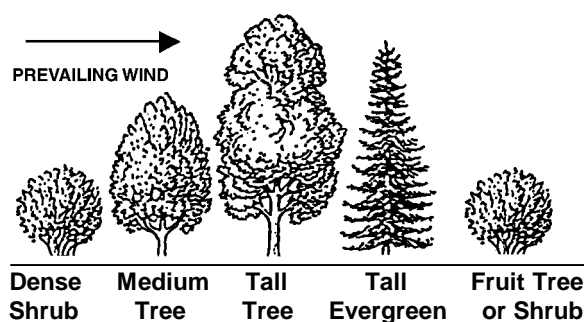


FIGURE 1 – The most effective windbreak planting has five (or more) rows of deciduous and evergreen trees/shrubs.

Do not plant slow growing species between two rows of fast growing trees.

Windbreak design density will vary based on the planned function of the barrier. Windbreak density is a function of the number of rows in the planting, the species and spacing used, and the season (leaf on versus leaf off).

Every multiple row planting shall have at least one outside (windward) shrub row.

Provide at least a 12 foot cultivated strip on all sides of the planting to serve as a fireguard, aid in the control of weeds, and reduce the amount of competition for available moisture.

For an L-shaped belt, design wide, round corners to facilitate cultivation and make the planting more effective.

Spacing

The space between rows of tree and shrub rows will be wide enough to accommodate cultivation equipment to control weeds. A minimum spacing is 15 feet.

Where two rows are used as a screen planting, they may be planted as close as 4 feet apart and treated as one row after the establishment period of 2-3 years.

TABLE 1. General Spacing Guidelines

PLANT TYPE	SPACING WITHIN ROW (FT.)	BETWEEN ROW (FT.)
Shrub	3 – 6	15 – 24
Tree	6 – 12	15 – 24

Site Preparation

Site preparation shall be sufficient for establishment and growth of selected species and appropriate for the site.

The planting area must be free of living sod and perennial weeds before planting.

One of the following methods will qualify for proper site preparation:

1. One year of summer fallow for cropland and idle land with little or no grass sod. Two years of summer fallow for sod and alfalfa.
2. A combination of cultivation and chemical weed control can be employed to destroy competitive vegetation.
3. Any land leveling or smoothing needed to facilitate irrigation must be done prior to planting. The irrigation system should be designed to provide water control independent of the adjoining fields.
4. Where cultivation is not feasible as with wet lands, steep slopes, erosive soils, or other areas, the vegetation will be scalped or killed on a 3-foot wide strip or spot on which the trees will be planted.

Care, Handling, and Size for Woody Planting Stock

Only viable, high quality and adapted planting stock or seed will be used.

Planting stock must be of known origin. Named varieties are recommended over common varieties and should be used when they are available. Utilize local nurseries for planting stock.

Planting stock will be stored in a cool, moist environment (34-38 degrees F). Keep stock tops dry and free of mold and roots moist and cool. Moist means roots are exposed to both water and air.

Roots of bareroot stock shall be kept moist during planting operations by placing in a partially aerated water-soil slurry, peat moss, super-absorbent (e.g. polyacrylamide) slurry or equivalent material.

Root medium of container stock shall be kept moist at all times by periodic watering.

Prior to planting, seedling shall not be less than ¼-inch in caliper at 1 inch above the root collar.

Use transplants that are 2 to 4 years old and at least 6 to 10 inches in height.

Planting

The planting shall be done at a time and manner to insure survival and growth of selected species.

Avoid planting trees or shrubs where they will interfere with structures or any above or below ground utilities or septic systems.

Stock shall not be planted when the soil is frozen. Plant into dry soil only if there is a way to irrigate or water woody plant materials afterwards.

Plant only when air temperatures are above freezing.

Do not plant on hot, windy days to avoid excessive drying.

Planting shall be done in early spring or late fall with dormant seedlings. A planting machine should be used if available and if the site allows.

Plant seedlings in a vertical position with root collars at or about inch below the soil surface. Pack soil around seedling to eliminate air pockets. Make the hole deep and wide enough for all roots to avoid causing “L” or “J” root and compacted root plantings.

On sloping sites, locate the plantings on the contour or as nearly on the contour as possible.

In large plantings, consider planting bare root conifers first for they are more susceptible to roots drying out.

Protection

The planting will be protected from adverse impacts such as livestock damage, wildlife damage or fire.

Protect windbreaks from livestock with fence.

On hot, dry south and west aspects, protect evergreens with shingles or burlap shades for the first two growing seasons. To protect evergreens from winter desiccation, place shingles or burlap shades on the sides the prevailing winds are coming from.

Additional Criteria for Twin Row-High Density Designs

Twin row-high density plantings may be used as an alternative design in appropriate settings. This design will consist of two closely spaced rows (four to six feet) using the same species in each set of paired rows. Row plantings should be staggered for maximum density.

The use of multiple twin rows can be very effective in reducing snow loading. Spacing between sets of twin rows can vary from 25 to 50 feet to achieve the desired objective.

Provide at least a 12 foot cultivated strip on all sides of the plantings to control vegetation and reduce competition for moisture.

Additional Criteria for Mulches, Fabric, and Tree Mats

Moisture conservation or supplemental watering shall be provided for plant establishment and growth where natural precipitation is too low for the selected species.

Geo-textile fabric, tree mats, and other appropriate organic mulch materials may be used for weed control and moisture conservation for new plantings on all sites.

Acceptable mulches, fabric, or mat materials must allow for water infiltration and air movement. Fabric mats will be a minimum of three feet by three feet in size and properly secured. Manufactured fabrics and tree mats must have a serviceable life span of at least three years.

When organic mulches are used, the material shall be placed in a minimum of four inches deep layer and at least a three feet wide radius around the seedling. Organic mulches should be kept at least six inches away from the main stem of trees and shrubs to minimize possible rodent damage.

Additional Criteria for Trickle Irrigation

Supplemental water may be provided as needed to improve establishment, health, and vigor of the woody plantings.

Practice Standard 441–Irrigation System, Trickle has been developed for detailed information regarding this practice.

Established plantings should receive sufficient water to fill the soil profile to a depth of six feet where soils permit. Infrequent deep irrigation will help control weeds and provide deep rooting for future dryland survival.

General irrigation should cease around August 15th to permit trees to harden off before frost. On light sandy or gravelly soils the shut off date can be later. But after trees have harden off, a late fall supplemental application of irrigation water, just before soil freezing, is very beneficial to trees if the soil is very dry. This is especially true for evergreens.

Additional Criteria to Reduce Wind Erosion: Protect Growing Plants

The windbreak will be oriented as close to perpendicular to the troublesome wind as possible. The interval between windbreaks shall be determined using current approved wind erosion technology to achieve the quality level for the soil or plant resource. **To protect growing plants from wind erosion** the distance sheltered by the barrier shall be 10 times the design height (H).

The wind erosion control system should consider temporary measures (i.e., herbaceous wind barriers, residue management, snow fences, etc.) to supplement the windbreak until it is fully functional.

Any design of one or more rows is acceptable for a field windbreak.

The density for a field windbreak should be 40-60 percent. This would be equivalent to a single row of conifer and a single row of deciduous.

Additional Criteria to Manage Snow

The windbreak will be oriented as close to perpendicular to the snow-bearing wind as possible.

For snow **distribution**, the windbreak density should be 25-35 percent (roughly the equivalent to single row of deciduous trees) and the interval between barriers will not exceed 20H.

For snow **accumulation**, the windbreak density should be 60-80 percent and the leeward row will be at least 100 feet from the area to be protected.

For state, county, or township roads the leeward row of plantings will be a minimum of 200 feet from the centerline of the road.

Select tree/shrubs that are less susceptible to snow breakage, such as species with more limber branches. For example: lilacs (limber branches) vs. skunkbush sumac (stiff branches).

Windbreaks will be located so that snow deposition will not adversely impact the area to be protected.

A snow trap of one or more dense shrub rows planting can be used to catch and deposit snow before it enters the shelterbelt or living snow fence. This planting should be approximately 100 feet windward and parallel to the primary planting.

Additional Criteria for Living Snow Fence

A minimum of three rows is needed to provide the minimum barrier density of 50 percent.

A suggested design utilizes three rows: row one, the windward row, should be a deciduous shrub, the second row should contain a deciduous tree and the third row should contain an evergreen tree or shrub.

Living snow fences should be oriented parallel to the road and at right angles to the prevailing snow moving winds or as close as possible.

The leeward row of plantings will be a minimum of 200 feet from the centerline of the road. Where the protected road sections are contained in deep cuts, the leeward row should be a minimum of 200 feet from the top of the cut. On four lane highways, use centerline of closest lane.

Extend both ends of the barrier at least 100 feet beyond the area to be protected.

Consult with officials and secure their approval when working near public roads. Make sure plantings do not obscure a drivers vision of road intersections or curves.

Additional Criteria to Provide Shelter for Structures and Livestock

For wind protection, the windbreak density should be 60-80 percent and the area to be protected will fall within 10H of the design height.

Three rows of plantings—with a least one row being a conifer—are required to provide the 60-80 percent density and the space required to store drifted snow in the windbreak.

Reduce the number of rows required for adequate protection by one if:

- 1) A snow trap of one or more rows of shrubs planted 100 feet windward and parallel to the primary planting; or
- 2) A field windbreak is located less than 660 feet windward and parallel to the primary planting.

Locate the windbreak so there will be a minimum of 100 feet between any building and the nearest row of woody plants.

For the most effective protection, plan windbreaks for at least two sides of the farmstead or feedlot. Extend the planting at least 100 feet beyond the main buildings or feedlots to control wind around the ends. The plantings should be long enough to provide protection of the whole area of farmstead or feedlot.

The openings for access lanes through windbreaks should be diagonal with the rows and at an angle to troublesome winds to prevent wind and snow from funneling into the farmyard.

Access roads next to the outside of the shelterbelt need to be at least 100 feet from the windward row of the windbreak/shelterbelt. This is to protect the road from being drifted in by trapped snow as a result of the windbreak/shelterbelt.

Consider including a drainage ditch for melting snow or rainfall on the leeward side of a livestock/feedlot shelter. This drainage ditch is between the shelter and the feedlot. The intent is to catch and drain any flow away before it has the capabilities of carrying any livestock waste offsite.

Additional Criteria to Provide Wildlife Habitat

To enhance the wildlife value of plantings, plant two or more rows of shrubs or conifers on the leeward side of multi-row plantings. Include fruit and berry producing shrubs where possible.

In multiple row plantings, containing more than three rows, the leeward rows may be planted in-groups or segments containing five or more plants of one species to enhance wildlife values. The greater the species diversity the better the windbreak/shelterbelt is for wildlife.

Use curver-linear rows or plant on the contour.

Plant a very narrow (2 to 4 feet) band of small grain or herbaceous cover between rows in alternate years.

Consider snow accumulation hazards in windbreak design for wildlife.

Additional Criteria for Screens and Barriers

Noise screens shall be dense, as tall as, and as close to the noise source as practicable.

Visual screens shall be located as close to the observer as possible.

Plantings for the purpose of screening will be of one or more rows. Limitations with respect to proximity with roads and buildings will also apply to screen plantings. Adequate space should be left for cultivation.

Consult with officials and secure their approval when working near public roads. Make sure plantings do not obscure a driver's vision of road intersections or curves.

Additional Criteria to Improve Aesthetics

Plantings along farmstead entrance lanes should be at least 100 feet from centerline of the lane and the nearest row of woody plants.

Use tree and shrub species with attractive form, foliage color, and flowers. Include conifers and other colorful species in the planting.

Adequate space should be left for cultivation.

CONSIDERATIONS

Spacing between windbreaks and rows of windbreaks may be adjusted, within limits of the criteria above, to accommodate widths of equipment.

Selection of plants for use in windbreaks should favor species or varieties tolerant to herbicides used in the area.

Plants that may be alternate hosts to undesirable pests should be avoided.

All plantings should compliment natural features.

Where water erosion and/or runoff from melting snow is a hazard, it should be controlled by supporting practices.

Wildlife needs should be considered when selecting tree or shrub species.

Species diversity should be considered to avoid loss of function due to species specific pests.

Plantings of less than five rows will have a different species in each row unless soil conditions limit the choice of species.

Consideration should be given to adverse offsite effects.

Obtain the history of pesticides applied at the site to be planted and what limitations they may impose prior to planting. Also consider pesticide drift from adjoining cropland.

PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site. Specifications shall be recorded using approved specifications sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance):

- Replacement of dead trees or shrubs will be continued until the barrier is functional.
- **Plants that have failed to grow shall be replaced not later than the second year. Void spaces are difficult to fill after the planting is over two years old. Gaps in the tree or shrub rows seriously reduce effectiveness and appearance of the planting.**
- Vegetative competition will be controlled.
- **Regular weed control is needed to maintain the establishment, health, and vigor of the plantings. Weed control is needed for the life of established windbreak.**
- **Cultivation down to 2-6 inch depth, between the rows, shall be timely and frequent enough to keep the planting reasonably free from weeds.**
- **Cultivate no deeper than three inches within the rows and no closer than two feet from the base of the plant. The optimum time to perform this activity is several times throughout the growing season.**
- **Some hand hoeing in the rows is desirable to remove weeds near the trees for at least three years after planting.**
- **Use caution in the application of chemical weed sprays in the vicinity of woody plantings. Strict adherence to label recommendations is essential to avoid damage to plantings.**

- **Mulches, fabrics, and tree mats will reduce the amount of maintenance needed to keep the planting growing and to control weeds.**
- **On sandy textured soils that will blow if left exposed, some light weed growth or a cover crop, 2-4 feet wide, may be left between the rows to control soil blowing.**
- **Provide at least a 12 foot cultivated strip on all sides of the planting to control weeds.**
- **Thin the barrier to maintain its function.**
- **Prune to eliminate weak or infected branches and repair injured trees.**
- **Damaging pests will be monitored and controlled.**
- **Maintaining the planting in a vigorous growing condition will aid in control of damaging pests. Early detection and application of control measures can often prevent extensive damage.**
- **Control deer and rodent damage by using fencing, repellents, poisoning or hunting. Hunting needs to be done within seasonal requirements of the Montana Department of Fish, Wildlife and Parks (DFW&P). Contact Montana DFW&P for more information and assistance on controlling big game species.**
- **Periodic applications of nutrients may be needed to maintain plant vigor.**
- **Protect plantings from fire by clean cultivation or the use of vegetative fire breaks.**

REFERENCES

Montana State University, Windbreaks for Montana—a landowners guide. July 1986. MSU Extension Service Bulletin 366, Bozeman, MT.

USDA—Natural Resources Conservation Service, Montana Field Office Technical Guide (FOTG), Section II—Conservation Tree/Shrub Suitability Groups.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.